

Text 2: Petroleum and the Environment

<p>Petroleum (or crude oil) is a complex, <u>naturally</u> occurring liquid mixture containing <u>mostly</u> hydrocarbons, but containing also some compounds of oxygen, nitrogen and sulfur. It is often referred to as the “black gold.” The Rockefellers, the Rothschilds, the Gettys, the Hammers and the royal families of the Persian Gulf area would <u>certainly</u> agree. A view at Fortune magazine's list of billionaires confirms it: The Sultan of the oil-rich Brunei, on the island of Borneo, has been at the very top for quite some time. Saudi Arabia's King Fahd is up there as well.</p> <p>After World War II, the huge oil reserves in the Middle East became available, at a very low cost, and they <u>rapidly</u> revolutionized the way we live. Indeed, the twentieth century – with all the dramatic changes that it has brought to society – is <u>probably</u> best characterized as the century of oil.</p> <p>Most of the world's petroleum is to be found in the Middle East. In particular, it is seen that the U.S. reserves are just an order of magnitude larger than the annual oil consumption. <u>Obviously</u>, United States imports a large portion of the petroleum that it consumes.</p>	Paragraph 1
<p style="text-align: center;"><u>Petroleum Formation</u></p> <p>Petroleum forms by the breaking down of large molecules of fats, oils and waxes that contributed to the formation of kerogen. This process began millions of years ago, when small marine organisms abounded in the seas. As marine life died, it settled at the sea bottom and became buried in layers of clay, silt and sand. The gradual decay by the effect of heat and pressure resulted in the formation of hundreds of compounds.</p> <p>Because petroleum is a fluid, it is able to migrate through the earth as it forms. To form large, <u>economically</u> recoverable amounts of oil underground, two things are needed: an oil pool and an oil trap. An oil pool, which is the underground reservoir of oil, may <u>literally</u> be a pool or it could be droplets of oil collected in a highly porous rock such as sandstone. An oil trap is a non-porous rock formation that holds the oil pool in place. Obviously, in order to stay in the ground, the fluids – oil and associated gas – must be trapped, so that they cannot flow to the surface of the earth. The hydrocarbons accumulate in reservoir rock, the porous sandstone or limestone. The reservoir rock must have a covering of an impervious rock that will not allow the passage of the hydrocarbon fluids to the surface.</p>	Paragraph 2
<p style="text-align: center;"><u>Properties of Petroleum</u></p> <p>The elemental composition of petroleum is much less variable than that of coal: 83-87% carbon, 11-16% hydrogen, 0-4% oxygen plus nitrogen, and 0-4% sulfur. Note that most crude oils contain <u>substantially</u> more hydrogen than coals. Only a brief discussion is needed here regarding the distribution of these elements among the thousands of compounds found in petroleum. Most of the compounds in petroleum contain from five to about twenty carbon atoms. Many of them consist of straight chains of carbon atoms (surrounded by hydrogen atoms).</p>	Paragraph 3

Petroleum Refining

We have seen that coal requires little processing before its (conventional) use for direct combustion purposes. We shall also see that natural gas requires little or no processing. In comparison, when crude oil is pumped from the ground, it may contain several hundred individual components, which range from liquids of very low boiling points to solid waxes. Crude oil could be used as a boiler fuel to make steam for process heating or electric power generation, but it is only marginally more desirable than coal (because of the convenience of handling liquids rather than solids). No other device can make efficient use of a substance having such a complex mixture of components. For example, imagine getting Vaseline (a petroleum-derived product) into the fuel injector or carburetor of your car! Imagine trying to pave a road with gasoline!

In principle, it is possible to separate each component of petroleum one-by-one, though this might take many repetitive distillation operations. However, to do so would be both very wasteful and prohibitively expensive. For example, suppose we had a supply of crude oil that contained 0.5% octane. Octane, C₈H₁₈, is a component of gasoline. If for some reason we wanted to use pure octane as a motor vehicle fuel, we would require 4.8 million barrels (some 200,000,000 gallons) of crude oil to produce 1,000,000 gallons of pure octane, after many distillation steps to purify the octane. On the other hand, 20% of a good crude oil might yield gasoline on simple distillation. Making 1,000,000 gallons of gasoline would require only 119,000 barrels of crude oil. Currently, pure octane can be purchased from chemical supply companies at about \$100 per liter, which is equivalent to some \$400 per gallon. In contrast, gasoline costs about \$1.30 per gallon. Few of us would drive very far if we had to pay \$400 for a gallon of fuel! Hence, a compromise is reached by separating petroleum into groups of components having reasonably similar properties. In that way, it is possible to make products having consistently uniform properties without incurring in the expense of separating the petroleum into individual chemical compounds.

This upgrading of crude oil into products tailored to meet specific consumer needs is what we mean by refining.

The key step in refining is distillation. Distillation is the separation of materials based on differences in their volatility (as indicated by their boiling points). Vapors from the heated crude oil rise and recondense continuously as they ascend within the column. The more volatile substances – those with the lower boiling points – become relatively enriched near the top of the column. Substances with very high boiling points are enriched near the bottom. At any given location in the column, there is a mixture of vapors corresponding to a liquid of particular composition and volatility. These vapors can be withdrawn from the column and condensed to form a liquid product. Such a liquid is still a mixture of many components, but in this case the components have fairly similar boiling points. The separation of crude oil by distillation is a physical process based on the fact that different chemical compounds have different boiling points. For example, pentane, C₅H₁₂, boils at 36 °C, while nonane, C₉H₂₀, boils at 128 °C. Because the separation is based only on a physical process – boiling – no chemical bonds are broken during distillation and no chemical reactions take place at this stage.

Exercise 1: Match a word in column A with a definition in column B			
Column A	Column B		Paragraph 2
An oil pool, which is	a non-porous rock formation that holds the oil pool in place the		
An oil trap is	by the breaking down of large molecules of fats		
Petroleum forms	the underground reservoir of oil		
Column A	Column B		Paragraph 3
The elemental composition of petroleum is	0-4%	carbon	
	0-4%	hydrogen	
	11-16%	oxygen plus nitrogen	
	83-87%	sulfur	
Note that most crude oils contain	from five to about twenty carbon atoms		
Most of the compounds in petroleum contain	substantially more hydrogen than coals		
Distillation is	C ₉ H ₂₀ , boils at 128 °C		Paragraph 5
pentane,	the separation of materials based on differences in their volatility		
nonane,	C ₅ H ₁₂ , boils at 36 °C		

Exercise 2: True or false?		True	False
0	After World War III, the huge oil reserves in the Middle East became available at a very low cost		
1	Obviously, United States exports a large portion of the petroleum that it consumes		
2	The twentieth century is probably best characterized as the century of gold		
3	Petroleum is a complex, naturally occurring solid mixture containing mostly hydrocarbons		
4	The twelfth century is probably best characterized as the century of oil		
5	Obviously, United States imports a small portion of the petroleum that it consumes		
6	After World War II, the huge oil reserves in the Middle West became available at a very low cost		
7	The twentieth century is certainly best characterized as the century of oil		
8	Petroleum is a complex, naturally occurring liquid mixture containing mostly electrons		
9	Obviously, United Arab Emirates import a large portion of the petroleum that it consumes		
10	The twentieth decade is probably best characterized as the century of oil		
11	After World War II, the huge oil reserves in the Middle East became available at a very high cost		
12	Obviously, United States imports a large portion of the petroleum that it produces		
13	After World War II, the huge oil reserves in the Middle East became available at a very low cost		
14	The twentieth century is probably best characterized as the year of oil		
15	Petroleum is a simple, naturally occurring liquid mixture containing mostly hydrocarbons		
16	Obviously, United States imports a large portion of the petroleum that it consumes		
17	The twentieth century is probably best characterized as the century of oil		
18	This process began thousands of years ago, when small marine organisms abounded in the seas		
19	Because petroleum is a solid, it is able to migrate through the earth as it forms		
20	This process began millions of days ago, when small marine organisms abounded in the seas		
21	Petroleum forms by the breaking down of tiny molecules of fats		
22	This process ended millions of years ago, when small marine organisms abounded in the seas		
23	Because petroleum is a fluid, it is unable to migrate through the earth as it forms		
24	This process began millions of years ago, when big marine organisms abounded in the seas		
25	Petroleum forms by the breaking away of large molecules of fats		
26	Because petroleum is a fluid, it is able to migrate through the earth as it forms		
27	This process began millions of years ago, when small marine organisms abounded in the sky		
28	Petroleum forms by the breaking down of large molecules of fats		
29	This process began millions of years ago, when small marine organisms abounded in the seas		

Paragraph 1

Paragraph 2

8	The separation of crude oil by <input type="text" value="d"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> is a physical process based on the fact that different chemical compounds have different <input type="text" value="b"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Points.
9	As international transport of oil becomes <input type="text" value="i"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> important, this potential problem must be added to the growing list of environmental problems associated with fossil fuel <input type="text" value="u"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
10	Most of the world's petroleum is to be found in the <input type="text" value="M"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> East.
11	In order to stay in the ground, the <input type="text" value="f"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> must be trapped, so that they cannot <input type="text" value="f"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> to the surface of the earth.
12	Because petroleum is a fluid, it is able to <input type="text" value="m"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> through the earth as it forms.

Verbs with two past tenses

N°	Verb	Meaning	Past simple Past participle	Example
1	Burn	To produce flames and heat		
2	Dream	To experience a series of images, events and feelings in your mind while you are asleep		
3	Kneel	To be in or move into a position where your body is supported on your knees		
4	Lean	To bend or move from a vertical position		
5	Leap	To jump high or a long way		
6	Learn	To gain language or skill by studying, from experience, from being taught, etc.		
7	Smell	To notice or recognize a particular smell		
8	Spell	To say or write the letters of a word in the correct order		
9	Spill	To flow over the edge of a container by accident,		
10	Spoil	To change something good into something bad, unpleasant, useless, etc.		

Terminology	مصطلحات	Terminologie	Terminology	مصطلحات	Terminologie
Petroleum			Refining		
Crude oil			Combustion		
Hydrocarbons			Steam		
volatility			Efficient		
Oxygen			Carburetor		
Nitrogen			Gasoline		
Sulfur			Octane		
Reserve			Continuously		
Consumption			Coals		
Magnitude			World War II		
Molecules			Middle East		
Waxes			Persian Gulf		
Kerogen			The twentieth century		
Clay			The gradual decay		
Silt			Boiling point		
Porous			Fuel injector		

Adverbs

N°	Adjective	Adverb	Meaning	Synonym	Example
1	Natural				
2	/				
3	Certain				
4	Rapid				
5	Probable				
6	Obvious				
7	Economical				
8	Literal				
9	Substantial				
10	Marginal				
11	Prohibitive				
12	Current				
13	Reasonable				
14	Consistent				
15	Continuous				
16	Relative				
17	Fair				

Exercise 4

Translation - Traduction - ترجمة

English

Petroleum (or crude oil) is a complex, naturally occurring liquid mixture containing mostly hydrocarbons, but containing also some compounds of oxygen, nitrogen and sulfur. It is often referred to as the “black gold.” After World War II, the huge oil reserves in the Middle East became available, at a very low cost, and they rapidly revolutionized the way we live. Indeed, the twentieth century – with all the dramatic changes that it has brought to society – is probably best characterized as the century of oil.

Petroleum Formation

Petroleum forms by the breaking down of large molecules of fats, oils and waxes that contributed to the formation of kerogen. This process began millions of years ago, when small marine organisms abounded in the seas. As marine life died, it settled at the sea bottom and became buried in layers of clay, silt and sand. The gradual decay by the effect of heat and pressure resulted in the formation of hundreds of compounds.

عربية

Français

Le pétrole (ou pétrole brut) est un mélange liquide complexe et naturel contenant principalement des hydrocarbures, mais contenant également certains

Le responsable de la matière : A. Benmoussa